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REC'D 29 MAY 2001

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PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference LAM/99058235	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. **PCT/SG00/00012**	International Filing Date *(day/month/year)* 31 January 2000	Priority Date *(day/month/year)* 2 February 1999
International Patent Classification (IPC) or national classification and IPC **Int. Cl.** [7] B22D 41/015, 41/62		
Applicant SINGAPORE POLYTECHNIC et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheet(s).

3. This report contains indications relating to the following items:

I	[X]	Basis of the report
II	[ ]	Priority
III	[ ]	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	[X]	Lack of unity of invention
V	[X]	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	[ ]	Certain documents cited
VII	[X]	Certain defects in the international application
VIII	[ ]	Certain observations on the international application

Date of submission of the demand	Date of completion of the report
30 August 2000	15 May 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **R.P. ALLEN** Telephone No. (02) 6283 2134

INTERNATIONAL PRELIM[redacted]RY EXAMINATION REPORT

[redacted]rnational application No.
PCT/SG00/00012

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description, pages **1-8**, as originally filed,
pages , filed with the demand,
pages , received on with the letter of

☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages **9-12**, received on **25 April 2001** with the letter of **25 April 2001**

☒ the drawings, pages **1-2**, as originally filed,
pages , filed with the demand,
pages , received on with the letter of

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

☐ restricted the claims.

☐ paid additional fees.

☐ paid additional fees under protest.

☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

☐ complied with.

☒ not complied with for the following reasons:

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

1. Claims 1-28. It is considered that the means for providing a high frequency alternating current, and means for superimposing a direct current comprises a first "special technical feature".

2. Claims 29-30. It is considered that the means for oscillating the position of the electrode comprises a second "special technical feature".

Since the abovementioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept, a priori.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☒ all parts.

☐ the parts relating to claims Nos.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims **2-12, 14-28**	**YES**
	Claims **1, 13, 29-30**	**NO**
Inventive step (IS)	Claims **2-12, 14-28**	**YES**
	Claims **1, 13, 29-30**	**NO**
Industrial applicability (IA)	Claims	**YES**
	Claims	**NO**

2. Citations and explanations (Rule 70.7)

Citations

(a) Patent Abstract of Japan, JP 63-144855 A (NIPPON KOKAN KK) 17 June 1988 & JP 63-144855 A
(b) EP 18450 A1 (IWATANI SANGYO KK) 12 November 1980
(c) GB 1035875 A (INTERNATIONAL BUSINESS MACHINES CORPORATION) 13 July 1966
(d) US 5846287 A (KUMAR et al.) 8 December 1998
(e) US 4670884 A (LETIZIA et al.) 2 June 1987
(f) US 3683094 A (SCHLIENGER) 8 August 1972
(g) US 4700769 A (OHARA et al.) 20 October 1987
(h) Derwent Abstract Accession No.18928W/11, Class M24, SU 429099 A, (CHELYABINSK METALLURG WK) 15 October 1974
(i) US 4110546 A (STENKVIST) 29 August 1978
(j) US 5168917 A (OKUDA et al.) 8 December 1992
(k) Patent Abstract of Japan, JP 56-151162 A (NAKASEKO ISAO) 24 November 1981
(l) US 4572673 A (PORTER et al.) 25 February 1986

Novelty & Inventive Step

Claims 1 & 13 — Citation (a) discloses all of the features of these claims.

Claims 29-30 — Citations (c) & (h) disclose all of the features of these claims.

Claims 2-12 & 14-28 — None of the citations, or obvious combination thereof, disclose all of the features of any of these claims.

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims 27-28 do not comply with Rule 6.2(a) because the claims should not rely on references to the description or the drawings.

CLAIMS

1. A method for producing a metal casting, comprising:
providing a metal in a crucible;

melting the metal in the crucible under an inert atmosphere using an arc from an electrode;

agitating the molten metal in the crucible by supplying a high frequency alternating current to the electrode;

superimposing a direct current to alter the balance of the alternating current; and

releasing the molten metal into a mould.

2. A method according to claim 1, in which the metal provided in the crucible comprises at least two parts of different compositions.

3. A method according to claim 1 or 2, further comprising stirring the molten metal in the crucible.

4. A method according to claim 3, in which the molten metal is stirred by establishing relative movement between the arc and molten metal in the crucible.

5. A method according to claim 4, in which the relative movement is established by oscillating the electrode.

6. A method according to any one of the preceding claims, in which the alternating current is of varying frequency.

7. A method according to any one of the preceding claims, wherein the DC supply can be switched between positive and negative.

8. A method according to any one of the preceding

claims, in which a positive direct current is superimposed for cleaning the molten metal.

9. A method according to any one of the preceding claims, further comprising varying the pressure of the inert atmosphere during melting.

10. A method according to any one of the preceding claims, further comprising heating the mould prior to pouring the molten metal.

11. A method according to any one of the preceding claims, further comprising introducing a pressure differential between the crucible and the mould to encourage molten metal flow from the crucible to the mould when pouring commences.

12. An item of jewellery cast by a method in accordance with any one of claims 1 to 11.

13. Apparatus for producing a metal casting, comprising a crucible, means for establishing an inert atmosphere around metal in the crucible, an electrode, means for supplying a high frequency alternating current to the electrode to generate an arc for melting metal in the crucible, and means for superimposing a direct current to alter the balance of the alternating current, and a mould for receiving molten metal from the crucible.

14. Apparatus according to claim 13, comprising means for switching the DC between positive and negative.

15. Apparatus according to claim 13 or 14, in which the stirring means comprises drive means for oscillating the position of the electrode.

16. A method according to any one of claims 13 to 15, in which the alternating current is of varying frequency.

17. Apparatus according to any one of claims 13 to 16, further comprising means for varying the pressure of the inert atmosphere established.

18. Apparatus according to any one of claims 13 to 17, further comprising a conduit communicating between the crucible and the mould, and having a valve for regulating molten metal flow through the conduit.

19. Apparatus according to claim 18, further comprising means for establishing a pressure differential across the valve for urging molten metal flow through the conduit when the valve is open.

20. Apparatus according to claim 19, in which the pressure differential establishing means comprises suction means for reducing gas pressure in the mould.

21. Apparatus according to any one of claims 13 to 20, in which the electrode is a tungsten electrode.

22. Apparatus according to claim 21, in which the tungsten electrode is part of a tungsten arc torch.

23. Apparatus according to any one of claims 13 to 22; further comprising means for varying the separation between the electrode and the crucible.

24. Apparatus according to any one of claims 13 to 23, in which the crucible is of graphite.

25. Apparatus according to any one of claims 13 to 24, in which the mould is of graphite.

26. Jewellery casting apparatus comprising apparatus

according to any one of claims 13 to 25.

27. A method of producing a metal casting substantially as hereinbefore described with reference to, and as illustrated in, the accompanying figures.

28. Apparatus for producing a metal casting substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

29. A method for producing a metal casting, comprising:
providing a metal in a crucible;

melting the metal in the crucible under an inert atmosphere using an arc from an electrode of a tungsten arc torch, stirring the molten metal by oscillating the electrode of the torch; and

releasing the molten metal into a mould.

30. Apparatus for producing a metal casting, comprising a crucible, means for establishing an inert atmosphere around metal in the crucible, a tungsten arc torch having an electrode, means for supplying electricity to the electrode to generate an arc for melting metal in the crucible, drive means for oscillating the position of the electrode to stir molten metal in the crucible, and a mould for receiving molten metal from the crucible.